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CRETACEOUS AND TERTIARY RHYNCHOLITES FROM THE
WESTERN ATLANTIC OCEAN AND FROM MISSISSIPPI

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ABSTRACT

The first rhyngolites from North America are described as *Rhyngolite americanus* TEICHERT & SPINOSA, n. sp. (Upper Cretaceous, Mississippi) and *Acutobeccus evansi* TEICHERT & SPINOSA, n. gen., n. sp. (Eocene, Mississippi). In addition, *Hadrocheilus* (*Arcuatobeccus*) *atlanticus* TEICHERT & SPINOSA, n. sp., is described from Lower Cretaceous rocks from about 1 m below the sea floor at 5,323 meters water depth from a locality northeast of San Salvador Island, Bahamas.

INTRODUCTION

Rhyngolites which are fossil objects generally recognized to be mandibles of cephalopods, have long been known from Mesozoic and, to a lesser extent, Tertiary rocks of Europe and the Mediterranean area, and from some areas farther east (TEICHERT, MOORE, & ZELLER, 1964). They were long believed to be absent from Mesozoic rocks in the western hemisphere, although IMLAY (1942) had in fact described a fragmentary specimen from the Cretaceous Viñales Limestone of Cuba, but this record was subsequently overlooked. In 1968, WINDISCH, *et al.*, identified and illustrated three small rhyngolites from a core in Lower Cretaceous rocks in the western North Atlantic, northeast of San Salvador Island, naming them "*Akidocheilus* cf. *ambiguus* TILL." The next record of rhyngolites in the western hemisphere was by HOUSA (1969) who described species of *Planecapula* and ?*Mesocheilus* from Neocomian rocks in Cuba. Specimens from the Permian

Kaibab Limestone of Arizona, believed to represent rhyngolites and described as *Rhyngoteuthis kaibabensis* by BRADY (1955), have recently been shown to be polyplacophoran remains (YOCHELSON, 1971). A suggestion made by TILL (1906, p. 148) that a specimen described as *Aptychus? knoxvillense* by STANTON (1895) from the Cretaceous of California may be a rhyngolite was rejected by TEICHERT, MOORE, & ZELLER (1964), and this opinion was confirmed by study of STANTON's type specimen (U.S. National Museum No. 23095) by TEICHERT in 1967.

The small assemblages described below considerably extend the geographical range of both Cretaceous and Eocene rhyngolites and they add a new genus to the very small number of rhyngolites known from rocks of Tertiary age. It is hoped that once rhyngolites become better known to American paleontologists they will be found in greater numbers than in the past.

Early in 1968, W. M. FURNISH and BRIAN F. GLENISTER brought to the attention of the junior author a number of rhyncholites in the collections of the Department of Geology of The University of Iowa. These had been collected about 1953 from Upper Cretaceous and Eocene beds in Mississippi. C. F. UPSHAW, then at Mississippi State University, sent the specimens to A. K. MILLER at the University of Iowa who thought "that the matter was well worth consideration" and that it "would make an interesting study" (letter from A. K. MILLER to C. F. UPSHAW, January 27, 1954). However, MILLER was never able to commence the study prior to his illness. This material is now described for the first time and we wish to thank W. M. FURNISH and BRIAN F. GLENISTER for having made it available to us for study.

At the same time we are able to add a more detailed study of some rhyncholites from the bot-

tom of the western North Atlantic through the great courtesy of MAURICE EWING, Lamont-Doherty Geological Observatory, who donated these specimens to the Museum of Invertebrate Paleontology of The University of Kansas. These small objects proved extremely difficult to photograph by light microscopy. RUSSELL M. JEFFORDS of the Esso Production Research Laboratory, Houston, Texas, then offered to have stereo scan photographs prepared in his laboratory. These turned out to be extremely satisfactory and we are much indebted to Dr. JEFFORDS for rendering this help. Finally, we are greatly indebted to REX E. CRICK, University of Kansas, who helped to pull the manuscript together in its final stages and who prepared the reference list, and to ROGER B. WILLIAMS, University of Kansas Paleontological Institute, who prepared the plates.

DISTRIBUTION OF RHYNCHOLITES

Rhyncholites are now known from all continents, except Australia and Antarctica. From South America undoubted rhyncholites have been described only from Late Pennsylvanian or Early Permian rocks, where they were found in association with an ammonoid identified as *Eoasianites* (CLOSS, 1967). CLOSS described these rhyncholites, but did not name them, since they clearly formed part of the anatomy of the associated ammonoids.

While rhyncholites are still rarities in Asia and in the western hemisphere, and generally in rocks of Tertiary age, they occur locally in greater

abundance in rocks of Middle Triassic and Early Jurassic to Late Cretaceous age in western and southern Europe and in the Tethys region as far east as the Crimea.

On Table 1 we have compiled data on the distribution of all rhyncholite genera known to us, except for *Tillicheilus* SHIMANSKIY (1947) for which reliable data cannot be compiled on the basis of available information. For *Rhyncho-teuthis* only the extra-European occurrences are shown. This genus is widely distributed in Lower Jurassic to Upper Cretaceous rocks in Europe.

SYSTEMATIC PALEONTOLOGY

Class CEPHALOPODA Cuvier, 1798

In the *Treatise on Invertebrate Paleontology*, Part K, SWEET (1964) credited the name Cephalopoda to CUVIER, 1797. In a publication entitled *Tableau élémentaire de l'histoire naturelle des animaux* CUVIER had indeed used the name in the form *Les Céphalopodes* for the first time, but the actual date of this publication is in doubt. The title page of the work bears the date "An VI", that is the Year 6 of the Romme calendar. This was the calendar of the

French Revolution which began to take effect on 22 or 23 September, 1792. "An VI", therefore, ran from 22 or 23 September, 1797, until 21 or 22 September, 1798. Since, according to Art. 21(6)(ii) of the *International Code of Zoological Nomenclature*, the last day of the year is to be interpreted as publication date of a publication for which only the year is specified, the date of publication of CUVIER's book must be assumed to be 21 or 22 September, 1798. This date was correctly stated by NELSON (1968, p. 16).

TABLE 1.—Generalized Stratigraphic and Geographic Distribution of Mesozoic and Tertiary Rhyncholite Genera. (Data mainly from Teichert, Moore, & Zeller, 1964; Gasiorowski, 1968.)

	M. Triassic	L. Jurassic	M. Jurassic	U. Jurassic	L. Cretac.	M. Cretac.	U. Cretac.	Tertiary
ALPS	1	2	1,2,3,4,5,6,13	2,3,4,5	1,2,3,4,5	1,2,3,4		
GERMANY	1,9	2	1	1	1		2,9	
NETHERLANDS							1	
POLAND			1				1	
CARPATHIANS			3,4,5,6	2,3,4,5	1,2,3,4,5			1
CZECHOSLOVAKIA							1	
HUNGARY					2,3			
CRIMEA				2,3,4,5	1,2,3,12	1,2,3		
DONETZ BASIN					1			
CAUCASUS				2,3,4,5	2,3			
SYRIA								1
EGYPT								1,9
ALGERIA					2		2	
MOROCCO								10
SPAIN				2,3,4,5				
MALTA								1
ITALY		2						1,7
FRANCE	1,9	1,2	2,3,4,5,6,11	2,3,4,5	2,3,4,5	1,3,4		
BELGIUM								1,9
ENGLAND		1				1,(2?),9	1,2	
INDIA							2,10	
CUBA					(3?),6			
SAN SALVADOR IS.					2			
MISSISSIPPI							1	8

1. *Rhyncholite*
2. *Hadrocheilus*
3. *Akidocheilus*
4. *Gonatocheilus*

5. *Leptocheilus*
6. *Mesocheilus*
7. *Scaptorhynchus*
8. *Acutocheilus*

9. *Conchorhynchus*
10. *Rhynchoteuthis*
11. *Palaeoteuthis*
12. *Erlangericheilus*
13. *Eurycheilus*

Order and Family UNCERTAIN

TERMINOLOGY OF RHYNCHOLITES

The descriptive terminology of rhyncholites employed by us is shown in Figure 1. It is similar to that given by HOUŠA (1969) to which we have added certain angular measurements as follows:

- α for the angle formed by the median keel and the ventral plane,
- β for the angle formed by the left and right anterior hood margins,
- γ for the angle formed by the left and right

posterior hood margins,

δ for the angle formed between the left and right shaft edges which circumscribe median shaft area.

Angular measurements have been previously used by TILL (1907) who, however, measured fewer elements than we.

CRETACEOUS RHYNCHOLITES

Genus RHYNCHOLITE Biguet, 1819

TYPE-SPECIES.—*Rhyncholite hirundo* BIGUET,

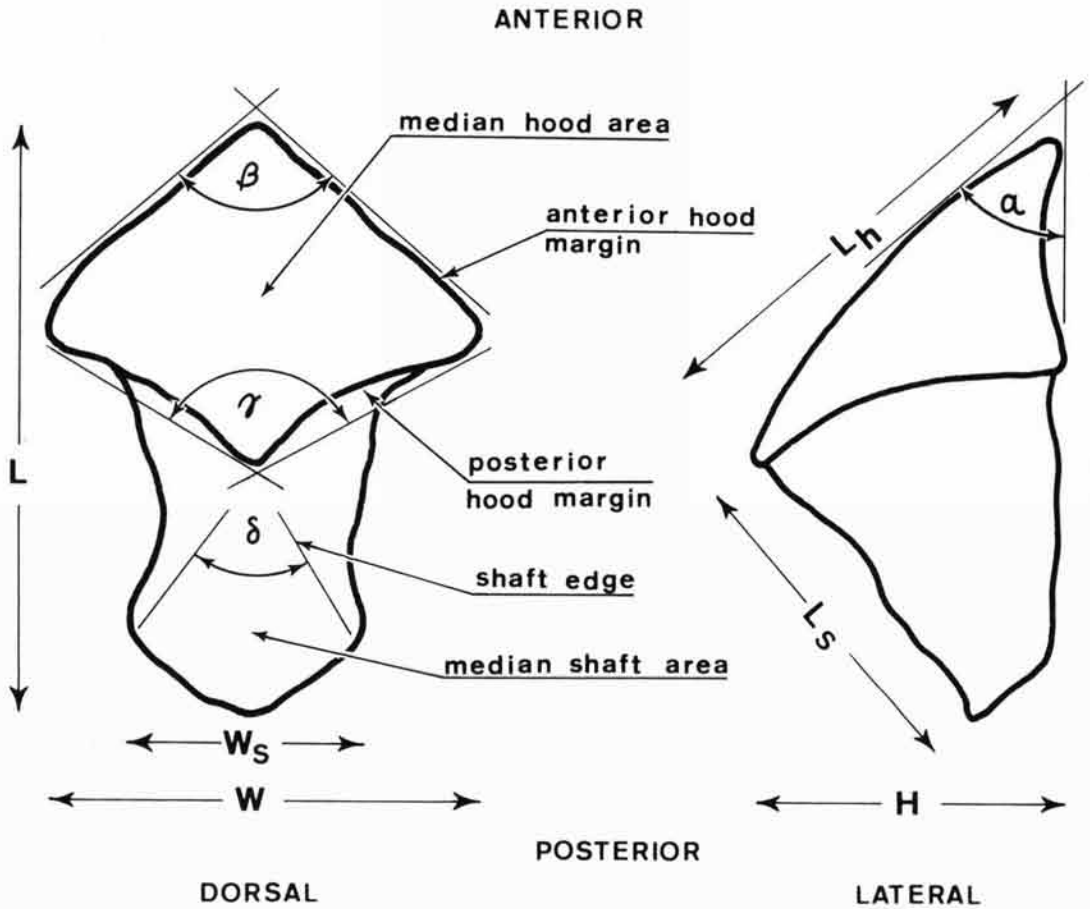


FIG. 1. Rhyncholite terminology and dimensions. [H , height of rhyncholite; L , length of rhyncholite; L_h , length of hood; L_s , length of shaft; W , width of rhyncholite (hood); W_s , width of shaft; for explanation of angles α , β , γ , δ see text.]

1819, p. 58 (by subsequent designation, TEICHERT, MOORE, & ZELLER, 1964, p. K447).

DIAGNOSIS.—Rhyncholite of medium to large size, with broad, high, rhomb-shaped hood, median hood area keeled to rounded, anterior hood margins meeting at approximately a right angle; shaft approximately as long as hood, rounded on dorsal surface, without furrow, shaft edges rounded to subangular; ventral surface slightly concave with relatively wide, low ridge; side views of hood and shaft triangular; lateral view of rhyncholite triangular.

DISCUSSION.—The genus *Rhyncholite* is restricted to rhyncholites having morphologic resemblance to the calcified portion of the upper mandibles of *Nautilus*. No representative of this

genus has previously been reported from the western hemisphere.

In general it seems that species of *Rhyncholite* are remarkably similar in shape throughout the long range of that genus from the Middle Triassic until the Miocene. The oldest known species is *R. hirundo* BIGUET, clearly recognizable already in figures published by GAILLARDOT (1824, pl. 22, fig. 15-26; reproduced in part by TEICHERT, MOORE, & ZELLER, 1964, fig. 338,2). More recently, discussions and illustrations of the species were published by MÜLLER (1963) who was impressed by the considerable variability in size and shape of its representatives.

The youngest species of *Rhyncholite* seems to be *Rhyncholite mediterraneus* (TILL) (1907, p. 541)

from the Miocene of Malta. This is a medium-sized species which is 23 mm long and 17 mm wide. The largest rhyncholite known is *Rhyncholite butleri* (CRICK) from the Jurassic of England which reaches a length of 51.7 mm and a width of 35.6 mm (CRICK, 1916).

DISTRIBUTION.—Middle Triassic to Miocene. Europe, North Africa (Egypt, Syria), North America (USA).

RHYNCHOLITE AMERICANUS

Teichert & Spinosa, n. sp.

Plate 1, figures 1-8; Plate 2, figures 1-6

MATERIAL.—Six, relatively well preserved, complete specimens.

DESCRIPTION.—Rhyncholite of relatively large size and robust appearance. Data on dimensions, proportions, and angular measurements of the specimens available to us are assembled in Table 2. In all specimens width (W) is approximately 75 percent of length (L), the W/L ratio varying between 62 and 79 percent. Height (H) is approximately 50 percent of length, the H/L ratio varying between 49 and 58 percent. Hood is rhomb-shaped and divided into symmetrical halves by a rounded median keel; the angle α , made by the median keel and the ventral plane, ranges from 35° to 45°. The angle γ , formed by the posterior hood margins, varies from 60° to 70°; a similar angle β , formed by the anterior hood margins, ranges from 80° to 100°.

The shaft is approximately half the total length of the rhyncholite and is about twice as long as it is wide. The shaft edges are somewhat rounded and diverge posteriorly at an angle (δ) of 30° to 35°. One specimen (SUI31986, Pl. 1, fig. 1-3) possesses a nearly perfectly rounded shaft, i.e., shaft edges are not conspicuously developed. The shaft is without furrow or ridge.

The ventral surface of the rhyncholite is concave, roughly arrow-shaped, and possesses a low,

longitudinal median ridge which expands slightly posteriorly; the ridge disappears into a slight depression at the posterior of the ventral shaft surface.

DISCUSSION.—The rhyncholite that seems to be most similar to *Rhyncholite americanus* is *R. donetzensis* SHIMANSKIY (1969), likewise of Maastrichtian age. The holotype and only specimen of that species has the following measurements (in mm): L 27, W 17, H 13, W/L .63, H/L .48. Although the Russian specimen is very slightly longer and higher than the largest Mississippi specimen, its measurements and proportions could well fall within the range of variation present in the Mississippi specimens. Degree of curvature of the hood of the holotype of *R. donetzensis* lies well within the range of that shown by the five specimens of *R. americanus*. The only significant difference between the two species might be in the smaller width of the shaft which in *R. donetzensis* is 6.5 mm, a figure below that for the smallest specimen of *R. americanus*. In a specimen of *R. americanus* equal in size to the holotype of *R. donetzensis* the width of the shaft might be expected to be greater than 9 mm which is the width of the shaft of the largest specimen (23.9 mm) of *R. americanus*.

Rhyncholite tilli (RÜGER, 1926) from lower Upper Cretaceous rocks in Germany is 32 mm long, thus even larger than *R. donetzensis*, and has an excessively wide shaft (about 17 mm). It is possible that the width of the shaft can be used as a characteristic useful in species diagnosis.

OCCURRENCE.—Prairie Bluff Chalk, Upper Cretaceous (Maastrichtian), Oktibbeha County, Mississippi.

[Holotype (SUI31983) and paratype (SUI31984) were collected by JAMES H. DORMAN at the Barr Pasture (also known as Barr Pond), NW¼, NW¼, Sec. 6, T.18N., R.15E., near the Mississippi State University laundry. Paratypes SUI31985 and 31986 were secured by JOHN F. HARRELL at exposures mainly on the east side of a gravel

TABLE 2.—Dimensions (in mm), Proportions, and Angular Measurements of *Rhyncholite americanus* Teichert & Spinosa, n. sp.

	L	W	H	L _s	W _s	L _b	W/L	H/L	α	β	γ	δ
Holotype SUI31983	23.9	17.9	11.6	14.8	9.0	16.3	.75	.49	35°	75°	100°	30°
Paratype SUI31985	22.8	14.1	11.0	12.5	7.9	16.1	.62	.48	35°	70°	80°	30°
Paratype SUI31984	22.4	15.1	12.0	11.0	7.9	16.5	.67	.54	35°	65°	85°	35°
Paratype SUI31988	19.9	15.8	10.0	13.0	X	13.5	.79	.50	35°	65°	90°	30°
Paratype SUI31987	19.8	15.4	11.5	9.0	7.0	16.0	.78	.58	40°	60°	90°	35°
Paratype SUI31986	19.5	12.0	10.2	11.0	7.5	14.0	.62	.52	50°	60°	80°	30°

road near SW corner of NE¼, NE¼, Sec. 21, T.19N., R.14E. Paratypes SUI31987 and 31988 were recovered by C. F. UPHAW in gullies on the Mississippi State University golf course (USGS localities 3186, 6843, 6844) W½, Sec. 1, T.18N., R.14E.]

REPOSITORY.—Holotype (SUI31983) and paratypes (SUI31984-31988) are in the collections of the Department of Geology, The University of Iowa.

Genus HADROCHEILUS Till, 1907

TYPE-SPECIES.—*H. theodosia* TILL, 1907, p. 586, by subsequent designation, TEICHERT, MOORE, & ZELLER, 1964, p. K479.

DISCUSSION.—The genus *Hadrocheilus* was established by TILL (1907, p. 568) who referred to it 35 species, not all of them finally and formally named. As was his custom, TILL described all the species in considerable detail, but nowhere did he provide a definition or description of the genus, nor did he do so in his later publications (1909a,b). The genus seems not to have been seriously discussed again until 1947, when SHIMANSKIY (1947, p. 1476) divided it into five subgenera, all of which, however, were only very briefly defined and for none of which any species other than the type-species was indicated.

SHIMANSKIY gave the following definition of *Hadrocheilus* (transl.): "Hood arrowlike, with clearly cut out posterior edge. Shaft large, widening toward posterior, usually carries furrow on upper side. Lower side convex, wavy, or concave-convex. Sculpture of lower side varied." The large, posteriorly widening shaft is characteristic of the Atlantic rhyncholites described below.

Subgenus HADROCHEILUS (ARCUATOBECBUS) Shimanskiy, 1947

TYPE-SPECIES.—*Hadrocheilus procerus* TILL, 1907, p. 606, by original designation.

DISCUSSION.—Of all the subgenera established by SHIMANSKIY, *Hadrocheilus (Arcuatobebcus)* seems to be best fitted to receive the rhyncholites described below. The only definition given by SHIMANSKIY (1947, p. 1476) is (transl.): "Lower side under hood slightly concave."

DISTRIBUTION.—Upper Jurassic to Lower Cretaceous. Europe (France, USSR), western North Atlantic.

HADROCHEILUS (ARCUATOBECBUS) ATLANTICUS Teichert & Spinosa, n. sp.

Plate 3, figures 1-9; Plate 4, figures 1,2

Akidocheilus cf. *ambiguus* TILL, WINDISCH, LEYDEN,

WORZEL, SAITO, & EWING, 1968, p. 1478, fig. 6, 1a-3b.

MATERIAL.—Three complete, moderately well to poorly preserved specimens, one of which disintegrated in the vacuum chamber during stereo scan photography.

DESCRIPTION.—Small, delicate rhyncholite of less than 4 mm maximum length. Data on dimensions, proportions, and angular measurements are presented in Table 3. In the three specimens available to us, width (W) is slightly greater than half the length (L), W/L ratio varying between 39 and 45 percent.

Hood is rhomb-shaped and divided into symmetrical halves by a rounded, unkeeled, medial hood area. Angle α , formed by the median keel and the ventral plane, measures approximately 50°; angle β , formed by the left and right anterior hood margins, measures approximately 70°, and angle γ , formed by the left and right posterior hood margins, is about 65°. The above angular measurements were taken on a single specimen and represent approximate values only. The shaft is slightly less than half the total rhyncholite length and approximately three-quarters as long as it is wide. The conspicuous shaft edges diverge postero-ventrally at about 70° (angle δ).

Ventral surface is conspicuously concave and roughly arrow-shaped. The central area, i.e., where the hood and the shaft are joined, is sharply constricted to approximately half the maximum width of the rhyncholite. The venter is marked by a rounded keel, whose sides slope gently to the lateral extremities, and which is restricted to the anterior portion of the hood. The remainder of the ventral hood area is a broad, flat platform which, at the anterior end of the shaft becomes a wide, shallow groove extending to the posterior extremity of the shaft.

DISCUSSION AND COMPARISONS.—Comparatively few rhyncholites have ventral sides that are so strongly concave as those of the present species. All species of *Gonatocheilus* have more or less strongly concave ventral sides, but in that genus the shaft is extremely short, in contrast to the long shaft of *Hadrocheilus (Arcuatobebcus) atlanticus*. A form described by TILL (1907, p. 608, pl. 12, fig. 23) as *H. ?proceriformis* also belongs to *Arcuatobebcus* and has an even more strongly concave ventral side than *H. (A.) atlanticus*. Comparable forms are *H. serrensis* TILL (1909a, p. 589), and *H. hamatoides* TILL (1909b, p. 414). *H. ?proceriformis* and *H. hamatoides* are Early

TABLE 3.—Dimensions (in mm), Proportions, and Angular Measurements of *Hadrocheilus* (*Arcuatobeccus*) *atlanticus* Teichert & Spinosa, n. sp.

	L	W	H	L _s	W _s	L _h	W/L	H/L	α	β	γ	δ
Holotype UK62172	3.5	1.81	1.35	1.65	1.91	2.70	.51	.39	49.5°	72.5°	67.5°	68.5°
Paratype UK62174	1.97	1.22	0.88	1.01	1.22	1.28	.62	.45	73.0°	69.0°	47.0°
Paratype UK62173	1.50	1.00	0.50	0.50	0.60	0.95	.64	.34	33.0°	77.5°	44.0°	56.0°

Cretaceous in age, *H. serrensis*, Early Jurassic. The age assignment of the rhyncholites is thus consistent with the age of foraminiferid species occurring with the rhyncholites in the same bed, as stated by WINDISCH, *et al.* (1968).

PRESERVATION AND NOTE ON ONTOGENY.—Specimen KU62173 showed very strong corrosion effects on its dorsal side which are seen in the $\times 120$ enlargements reproduced on Plate 4. Unfortunately, it is this specimen which disintegrated in the vacuum chamber of the stereo scan microscope. It would have been valuable to be able to reexamine the specimen after the stereo scan pictures had been obtained.

Rhyncholites consist of horny substance and of calcite. As a rule it is only the calcitic body that is preserved and this is also true for the specimens of *Hadrocheilus* (*Arcuatobeccus*) *atlanticus*. As is seen in Plate 3, figure 1, and still better in Plate 4, figures 1 and 2, corrosion has brought out the growth lamellae very clearly in part of the hood of the specimen. There seem to be 5 to 6 laminae present in a distance of 0.1 mm, so that the thickness of individual laminae is of the order of 16 to 20 microns. It is, furthermore, obvious that the laminae are oriented parallel to the outer edge of the hood and it is thus clear that the specimen did not change its general shape and proportions during ontogeny. This is in marked contrast to conditions that MÜLLER (1963) described in *Rhyncholite hirundo* from the Middle Triassic of Germany. Here configuration of the growth lamellae, as observed in thin sections, shows that this species underwent considerable changes in shape during ontogeny (see especially MÜLLER, 1963, p. 23, and fig. 17-19). Also the thickness of the lamellae seems to be much greater; as far as one can judge from the photographs, it should be of the order of 0.5 mm.

Interesting as these observations are, it is impossible to generalize, because investigations on the ontogeny of rhyncholites are far too few.

The dorsal surface of specimen KU62174 (Pl. 3, fig. 7.9) is also corroded, though in a different

way. The origins of these corrosion effects are difficult to judge. It would be tempting to think that these rhyncholites were deposited at, or close to, a depth at which calcite would be dissolved in water undersaturated with calcium carbonate, that is, in rather deep water, but no firm conclusions can be drawn in this respect.

OCCURRENCE.—Lower Cretaceous strata (Barremian-Hauterivian) at the bottom of the Atlantic Ocean, north-east of San Salvador Island.

[Holotype KU62172 and two paratypes KU62173, 62174 were recovered from the base of a 139 cm long core (Core no. V 24-13) in the western North Atlantic at 5,323 meter water depth; location: 24°44' N, 73°41' W. For details, see WINDISCH *et al.*, 1968. Material was made available for study through the courtesy of MAURICE EWING, T. SAITO, and the Lamont-Doherty Geological Observatory.]

REPOSITORY.—Holotype (KU62172) and one paratype (KU62174) are in the Museum of Invertebrate Paleontology, University of Kansas. The other paratype (KU62173) unfortunately disintegrated in the vacuum chamber of the electron scanning microscope.

TERTIARY RHYNCHOLITES

Rhyncholites are the greatest of rarities in rocks of Tertiary age and they are not known from rocks younger than Miocene. In an attempt to discover any rhyncholites resembling the specimen from the Eocene of Mississippi, described below as *Acutobeccus evansi*, n. gen. *et n. sp.*, a thorough search was made of the entire literature in which Tertiary rhyncholites have been mentioned or described. The list that we came up with follows and in it no attempt has been made to update the taxonomy or change original spellings.

In view of the great scarcity of rhyncholites in Lower to Middle Tertiary rocks, contrasted with the relatively much greater abundance of nautiloids in rocks of that age, the thought suggests itself that perhaps Tertiary rhyncholites, with the exception of *Ryncholite*, were not mandibles of nautiloids.

LIST OF TERTIARY RHYNCHOLITES

- Rhyncholites allionii* BELLARDI, 1873 (p. 52, pl. 3, fig. 2a-c). Lower-middle Miocene, NW. Italy.
- Scaptorhynchus miocenicus* BELLARDI, 1873 (p. 43, pl. 1, fig. 2a-c). Lower-middle Miocene, NW. Italy.
- Rhyncholites* sp. VINCENT, 1901 (p. vii, text-fig. 1-8). Middle Eocene, Belgium.
- Conchorhynchus* sp. VINCENT, 1901 (p. vi, text-fig. 9-17). Middle Eocene, Belgium.
- Rhyncholites allionii* BELLARDI var. *percrassa* SACCO, 1904 (p. 8, pl. 3, fig. 3). Miocene, NW. Italy.
- Rhyncholites rosavendae* SACCO, 1904 (p. 8, pl. 3, fig. 4). Miocene, NW. Italy.
- Rhyncholites?* *suballionii* SACCO, 1904 (p. 8, pl. 3, fig. 5). Miocene, NW. Italy.
- Rhyncholites paronae* [recte *paronai*] SACCO, 1904 (p. 9, pl. 3, fig. 6) (= *Rhyncholites* f. n. PARONA, 1898, p. 166, pl. 13, fig. 11). Lower-middle Miocene, NW. Italy.
- Rhyncholites formae* SACCO, 1904 (p. 9, pl. 3, fig. 7) (= *Rhyncholites* f. n. PARONA, 1898, p. 166, pl. 13, fig. 10). Lower-middle Miocene, NW. Italy.
- Rhyncholites eogassinensis* SACCO, 1904 (p. 10, pl. 3, fig. 8) (= *Rhyncholites* f. ind., PARONA, 1898, p. 160, pl. 13, fig. 4). Lower Oligocene, NW. Italy.
- Rhyncholites mediterraneus* TILL, 1907 (p. 541) (=figured, but unnamed specimen, FOORD, 1891, p. 371, text-fig. 83). Miocene, Malta.
- Rhyncholites albestii* POPESCUE-VIOTESTI in TILL, 1911 (p. 364) (*nom. nud.*). Middle Eocene, Rumania.
- Rhyncholites oppenheimi* TILL, 1911 (p. 364) (= *Rhyncholites* sp., OPPENHEIM, 1906, p. 345, pl. 27, fig. 24). Middle-upper Eocene, Egypt.
- Conchorhynchus oppenheimi* TILL, 1911 (p. 364) (= *Conchorhynchus* sp. OPPENHEIM, 1906, p. 345, pl. 27, fig. 25). Middle-upper Eocene, Egypt.
- Rhynchoteutis* [sic] sp. LOSSEL, 1947 (p. 282, text-fig. 1-3). Upper Miocene, Morocco.
- Rhyncholite* sp. GASTOROWSKI, 1968 (p. 18). Tertiary, eastern Carpathians.
- Rhyncholite* sp. GASTOROWSKI, 1968 (p. 18). Tertiary, Syria.

Genus ACUTOBECCUS
Teichert & Spinosa, n. gen.

TYPE-SPECIES.—*Acutobeccus evansi* TEICHERT & SPINOSA, n. gen. and n. sp.

DIAGNOSIS.—Rhyncholite with elongate, thin hood resembling a narrow rhombus; shaft greatly reduced in size, located below posterior half of hood; venter marked by conspicuous, narrow ridge; ventrolateral margins of shaft form ridges extending anteriorly to lateral hood extremities.

DISCUSSION.—While *Acutobeccus* is undoubtedly a rhyncholite in the generally accepted sense, the genus is so unlike any previously known forms that it is difficult to make comparisons. With *Scaptorhynchus* BELLARDI from the Miocene of Italy it shares the feature of the short shaft, but here the resemblance ends, *Scaptorhynchus* having a hood in the shape of an isosceles triangle. All other illustrated rhyncholites of Tertiary age differ considerably in greater length of the shaft and also in general size.

EXPLANATION OF PLATES

(SUI=University of Iowa; KU=University of Kansas, Museum of Invertebrate Paleontology.)

PLATE 1

Rhyncholite americanus TEICHERT & SPINOSA, n. sp.

FIGURE

- 1-3.—SUI31986, dorsal, ventral, lateral views, $\times 3$.
4,5.—SUI31985, dorsal, lateral views, $\times 3$.
6-8.—SUI31984, dorsal, ventral, lateral views, $\times 3$.

PLATE 2

Rhyncholite americanus TEICHERT & SPINOSA, n. sp.

FIGURE

- 1-3.—SUI31987, dorsal, ventral, lateral views, $\times 3$.
4-6.—SUI31983, dorsal, ventral, lateral views, $\times 3$.

Acutobeccus evansi TEICHERT & SPINOSA, n. gen., n. sp.

FIGURE

- 7-9.—SUI31989, dorsal, ventral, lateral views, $\times 3$.

PLATE 3

Hadrocheilus (*Arcuatobeccus*) *atlanticus* TEICHERT & SPINOSA, n. sp.

FIGURE

- 1-3.—KU62173, dorsal ($\times 32$), lateral ($\times 37$), ventral ($\times 32$) views. [Specimen destroyed.]
4-6.—KU62172, dorsal ($\times 18.5$), lateral ($\times 19$), ventral ($\times 18.5$) views.
7-9.—KU62174, dorsal, lateral, ventral views, all views $\times 37$.

PLATE 4

Hadrocheilus (*Arcuatobeccus*) *atlanticus* TEICHERT & SPINOSA, n. sp.

FIGURE

- 1,2.—Enlarged views of parts of ventral side of KU62173, $\times 120$. [Specimen destroyed.]



1



2



3



4



5



6



7



8





1



2



3



4



5



6



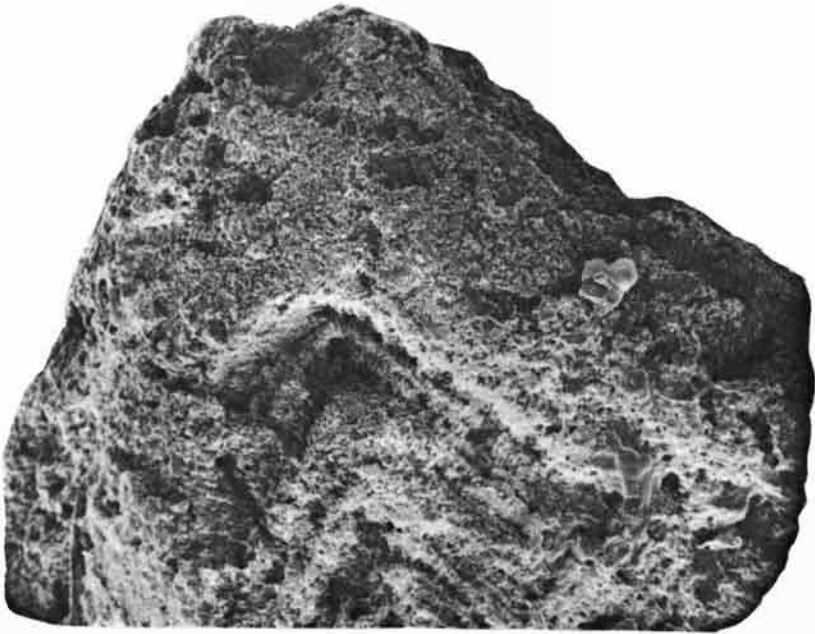
7



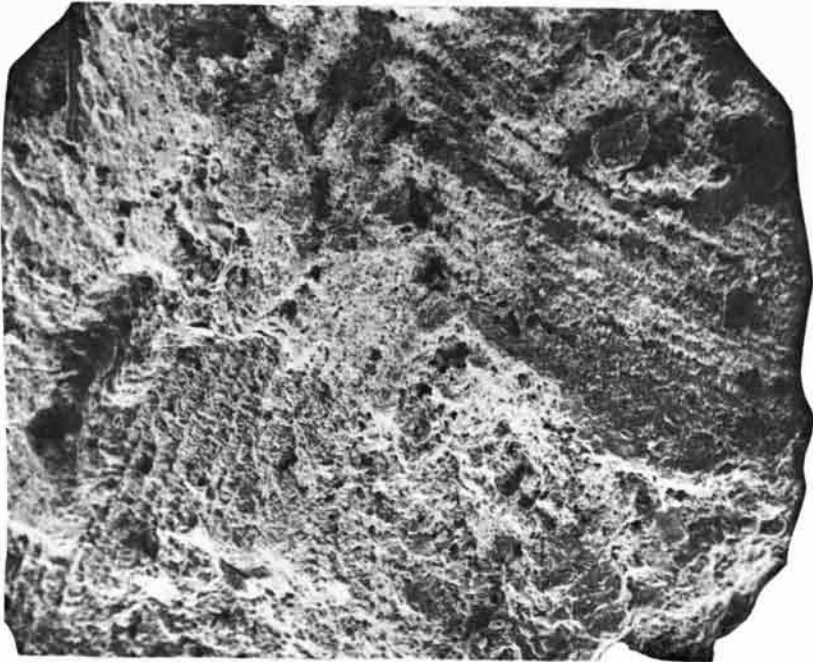
8



9



1



2

TABLE 4.—Dimensions (in mm), Proportions, and Angular Measurements of *Acutobeccus evansi* Teichert & Spinosa, n. sp.

	L	W	H	L _s	W _s	L _h	W/L	H/L	α	β	γ	δ
Holotype SUI31989	20.5	12.5	7.2	6.6	4.8	19.7	.61	.35	25°	65°	50°	45°

According to MILLER (1947, p. 81-85, pl. 56, fig. 7-9), the only nautiloid known from rocks of the Jackson Group is *Aturia alabamensis* (MORTON) which he also records from the Yazoo Formation. However, since *Aturia* has worldwide distribution in rocks of Early Tertiary and Miocene age, the unique *Acutobeccus* is unlikely to have been associated with that nautiloid genus.

ACUTOBECCUS EVANSI Teichert & Spinosa, n. sp.

Plate 2, figures 7-9

MATERIAL.—The holotype (SUI31989) is the only known representative of this species.

DESCRIPTION.—The most conspicuous characteristic of this unique specimen is the thin, gently arcuate, elongate, rhombus-shaped hood which is approximately 20.5 mm long and about half as wide as it is long. Its median dorsal area is divided by a low, inconspicuous keel which changes into a shallow furrow in the posterior one-quarter of the hood. The anterior margins of the hood meet at an angle (β) of 50°; the posterior margins

meet at an angle (γ) of 65°. The shaft is unusually small; the "dorsal," or upper, shaft surface is directed ventrally, i.e., at right angles to the dorsal hood surface. The shaft is located under the posterior half of the hood and thickens posteriorly. The shaft edges are rounded. The ventral surface is marked by a conspicuously raised ridge which extends nearly the entire length of the rhyncholite but becomes greatly reduced near the posterior end. The ventrolateral margins of the shaft extend anteriorly as ridges to the lateral extremities of the hood. All measurements for the holotype are compiled in Table 4.

DISCUSSION AND COMPARISONS.—See under description of genus.

OCCURRENCE.—Shubuta Member of Yazoo Clay, Jackson Group (Eocene), in gullies on the Shubuta Hereford Ranch pastures on north side of road approximately along the north line of NW¼, Sec. 10, T.10N., R.7W., Clarke County, Mississippi (collected by THOMAS J. EVANS).

REPOSITORY.—The holotype (SUI31989) and only known representative is in the collections of the Department of Geology, The University of Iowa.

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